

# Differentiated Instruction Intensive Institute: Advanced Content & Application January 15, 2013 - January 16, 2013

**A-1**

## Enhancing the DI Experience: Critical Thinking, Creativity & Innovation for Teachers & Students

**Rick Wormeli**

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# Enhancing the DI Experience

## Critical Thinking, Creativity, and Innovation

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### Six Word Memoirs

Sample:

"For sale: baby shoes, never worn." - Ernest Hemingway

Other Samples:

Need more friends or more hobbies.

Old age approaches. Better start now.

My entourage asleep in his crib.

Some shoes will take you anywhere.

Life packed neatly away in boxes.

My greatest ideas involve duct tape.

Two eyes open, but still nearsighted.

Hobby became job. Seeking new hobby.

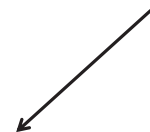
**Take a moment or three,  
and write your own  
6-word memoir that captures  
your attitude toward, or your  
history with, differentiation.**

### Do we have the creativity to solve our own problems?

- My whole lesson today is based on accessing those three Websites, but the school's Internet is down, so what can we do instead?
- Small groups are not working in my class, yet I know they're important for many students' learning. How do I get these students to stay focused on their group tasks?
- I've backed myself into a corner explaining an advanced science concept, and it's not making sense to me, let alone to my students. What should I do?
- Angelica doesn't understand the concept after my explanation, but I don't know any other way to teach it. What will I do?

- I'm supposed to differentiate for some of my students, but I don't see any time to do it.
- My school's current electronic gradebook system doesn't allow me to post anything but norm-referenced scores, and I want to be more criterion-referenced in my grades. What can I do?
- Because I'm a veteran teacher, I've been asked to be the rotating teacher using a cart and moving from classroom to classroom each period so the new teacher can have his own room and not have so much to deal with his first year. How will I handle this?

**Our future depends on  
this one here.**



### Consider:

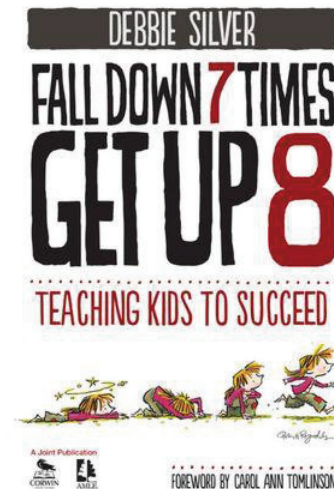
Immigrants invent patents at double the rate of non—immigrants. (p. 240, Lehrer)

“Countries with higher PISA scores have fewer people who are confident in their entrepreneurial capabilities. Out of the innovation-driven economies, Singapore, Korea, Taiwan, and Japan are among the best PISA performers but their scores on the measure of perceived capabilities or confidence in their ability to start a new business are the lowest.”

(Downloaded June 25, 2012, Test Scores vs. Entrepreneurship: PISA, TIMSS, and Confidence,” research from forthcoming book, *World Class Learners: Educating Creative and Entrepreneurial Students*, Y. Zhao)

### Consider:

- “Stick-to-itive-ness” builds creativity
- 10,000 hours (Gladwell)
- Automaticity in response is not really thinking, it's reacting.
- Don't demonize failure



New  
from  
Dr.  
Debbie  
Silver!

### Research-based Practices...

‘Nice to have, but four cautions:

1. *Some educational research is done poorly. Claims based on some data are not justifiable. Some studies are intensely specific to subject and testing conditions and therefore cannot be used to justify applications to wider groups. Read the study's limitations at the end of the research. Consider who is doing the research and check for bias. Read the original study!*
2. *Not all that is wise and wonderful in education has a research base. Don't dump an idea because there's no formal research behind it. Anecdotal research can be helpful.*
3. *Even the most sound, research-based strategies can have wildly varying results when used in varying populations and circumstances.*
4. *Teachers must get much better at analyzing practice and adjusting lessons as a result of those reflections. To do this, they must be well-read in their field, and a full participant in their profession.*

## Is creative thinking the same as critical thinking?

Creative Thinking – generative, nonjudgmental and expansive. When you are thinking creatively, you are generating lists of new ideas.

Critical Thinking – analytical, judgmental and selective. When you are thinking critically, you are making choices.

<http://ericbrown.com/critical-thinking-vs-creative-thinking.htm> September 5, 2008 By Eric D. Brown

### Critical Thinking

analytic  
convergent  
vertical  
probability  
judgment  
focused  
objective  
answer  
left brain  
verbal  
linear  
reasoning  
yes but

From [www.virtualsalt.com](http://www.virtualsalt.com)

### Creative Thinking

generative  
divergent  
lateral  
possibility  
suspended judgment  
diffuse  
subjective  
an answer  
right brain  
visual  
associative  
richness, novelty  
yes and

<http://eduscapes.com/tap/topic69.htm>:

Critical thinking involves logical thinking and reasoning including skills such as comparison, classification, sequencing, cause/effect, patterning, webbing, analogies, deductive and inductive reasoning, forecasting, planning, hypothesizing, and critiquing.

Creative thinking involves creating something new or original. It involves the skills of flexibility, originality, fluency, elaboration, brainstorming, modification, imagery, associative thinking, attribute listing, metaphorical thinking, forced relationships. The aim of creative thinking is to stimulate curiosity and promote divergence.

Here's one definition of creativity that works pretty well for educators:

**"Creativity is the ability to imagine or invent something new...the ability to generate new ideas by combining, changing, or reapplying existing ideas. Some creative ideas are astonishing and brilliant, while others are just simple, good, practical ideas that no one seems to have thought of yet."**

**It's also an attitude: "...the ability to accept change and newness, a willingness to play with ideas and possibilities, a flexibility of outlook, the habit of enjoying the good, while looking for ways to improve it."**

From <http://www.virtualsalt.com/crebook1.htm>

## Creativity Inhibitors

- Lack of time
- Different priorities
  - It's not evaluated or emphasized.
- The idea that problems have one solution.
  - Lack of practice
- Lack of skill development in creativity
  - Lack of resources
- Entrenchment: "We've always done it this way."

(Invention of hot dog example)

- "The need to be right all the time is the biggest bar there is to new ideas." (P. 108, de Bono)
- Teachers lack autonomy:
  - ✗ Mandated scripted programs with no option to adjust it according to students' needs...
  - ✗ "We must maintain fidelity to the program..."
  - ✗ Teachers are warned to plan accordingly because the paper supply will run out in January...
  - ✗ The master schedule cannot be changed to accommodate a compelling guest speaker...
  - ✗ Teachers can't incorporate a new "app" in their lessons because it promotes the use of personal technology that school hasn't sanctioned...
  - ✗ New students are three grade levels below grade-level proficiencies but they must do well on the final exam anyway...
  - ✗ No, you can't take that field trip with the class because you only get one per year, and it would be too much time away from preparing for the annual exam

### Interesting:

Cities are more creative than companies..."Cities are unruly places, largely immune to the desires of politicians and planners. 'Think about how powerless a mayor is,' West says. "Mayors can't tell people where to live or what to do or who to talk to. Cities can't be managed, and that's what keeps them so vibrant."

Great ideas inspire other great ideas... "Because when ideas are shared, the possibilities do not add up. They multiply."

(p. 210, 222, Lehrer)

### Remember,

We all want the pilot who thinks "outside the box" when the plane's navigational system fails at 35,000 feet, and we want teachers to think in unusual ways if the regular curriculum or lesson plan isn't working.

Inducting, deducting, revealing logical fallacy/consistency, making connections, revising thinking in light of new evidence, analyzing situations, and responding flexibly: We want those trusted to create the future via today's students to perform these tasks well.

School reformers do better to train teachers to think and act creatively than they do spending time and money teacher-proofing instruction.

- Negative attitudes towards children and colleagues who are creative.

"Teachers asked if they want creative kids in their rooms, and all said yes. When these same teachers rated their students on a variety of personality measures, the traits most closely aligned with creative thinking were also closely associated with their "least favorite" students. Those daydreamers and improvisers might have been imaginative, but they were harder to teach and they underperformed on standardized tests. As they result, they were routinely dismissed and discouraged. 'Judgements for the favorite student were negatively correlated with creativity.'" (p. 230, Lehrer)

- Giving up. "It can't be done."
  - Lack of confidence
- Perceived lack of creativity
  - Fear of looking foolish
- Peer pressure, Pressure to conform, Politics
  - Fear of failure
- Bias, preconceived notions
- Singular, myopic perspective
  - Learned helplessness

1

1 1

2 1

1 2 1 1

1 1 1 2 2 1

3 1 2 2 1 1

1 3 1 1 2 2 2 1

1 1 1 3 2 1 3 2 1 1

Discern the Pattern and  
Fill in the Last Row of  
Numbers

From, *Creative Thinkering*, 2011, Michael Michalko,  
p. 44

Cool Ideas now in production:

"Blend a grid of LEDs with wireless communication platform and have the pillows emit a soft glow when one is touched. Two lovers can be separated by thousands of miles, and when each hugs one pillow, the other pillow – thousands of miles away – will respond with a soft glow."  
-- p. 39, *Creative Thinkering*

Musical umbrella: " -- five different types of waxed fabric with varying degrees of elasticity to create a range of tones and frequencies, depending on the size and speed of the falling raindrops."

-- p. 68, *Creative Thinkering*

“Do they know how to ask good questions?”

-- Tony Wagner, *The Global Achievement Gap*, 2008

It's not  
an *answer*  
*chase*.

It's a *question journey*.

“We went to school. We were not taught how to think; we were taught to reproduce what past thinkers thought....  
...Instead of being taught to look for possibilities, we were taught to exclude them. It's as if we entered school as a question mark... ...and graduated as a period.”

-- Michael Michalko,  
*Creative Thinking*,  
2011, p. 3

Writer, Mark Bauerlein, speaking about today's students surfing the Internet:

Their choices are never limited, and the initial frustrations of richer experiences send them elsewhere within seconds. With so much abundance, variety, and speed, users key in to exactly what they already want. Companionship is only a click away....Why undergo the labor of revising values, why face an incongruent outlook, why cope with disconfirming evidence, why expand the sensibility...when you can find ample sustenance for present interests? Dense content, articulate diction and artistic images are too much....They remind them of their deficiencies, and who wants that? Confirmation soothes, rejections hurts. Great art is tough, mass art is easy. Dense arguments require concentration, adolescent visuals hit home instantly. “

**For students to think creatively or critically in our classes, we have to be developmentally responsive.**  
**Identify how your lessons and interactions with students reflect expertise with the unique nature of the students you serve.**

### Highly Effective Strategies for Today's Students:

- Arguing/Defending Position
- Project-based learning
- Novelty
- Technology incorporation
- Self-assessment in relation to goal
- Collaboration

### Vividness

- **"a lot"** – Running to each wall to shout, "a" and "lot," noting space between
- **Comparing Constitutions – Former Soviet Union and the U.S. – names removed**
- **Real skeletons, not diagrams**
- **Simulations**
- **Writing Process described while sculpting with clay**



### Accountable Talk

(p.23, *Checking for Understanding*, ASCD, 2007)

- Press for clarification – "Could you describe what you mean?"
- Require justification – "Where did you find that information?"
- Recognize and challenge misconceptions – "I don't agree because..."
- Demand evidence for claims – "Can you give me an example?"
- Interpret and use others' statements – "David suggested that...."

### Advanced Thinkers...

- Concede ignorance when they are ignorant.
- Find out what's going on.
- Respect intellectuals and don't deride them.
- Speak out after doing their homework.
- Examine superstitions.
- Play thinking games and amuse themselves by trying to answer puzzle questions.
- Become more informed about history than they are.

### Advanced Thinkers...

- Aren't afraid to change their minds.
- Are aware that their opinions, assumptions, and beliefs are often affected by peer-group pressure.
- Are realistically skeptical – even of leaders.
- Recognize that they have personal prejudices.
- Do not to fall in love with their first answers.

[from Steve Allen's book, *Dumbth: The Lost Art of Thinking: with 101 Ways to Reason Better and Improve your Mind* (Prometheus Books)]

**Creativity is making connections between dissimilar things in such a way as to create something new.**

**It's often about recombining old ideas and things for new purposes or perspectives.**

From Professor Alane Starko in her book, *Creativity in the Classroom*:

Gutenberg developed the idea of movable type by looking at the way coins were stamped.

Eli Whitney said he developed the idea for the cotton gin while watching a cat trying to catch a chicken through a fence.

Pasteur began to understand the mechanisms of infection by seeing similarities between infected wounds

Einstein used moving trains to gain insight into relationships in time and space.

**“Consider Einstein’s Theory of Relativity. He did not invent the concepts of energy, mass, or speed of light. Rather he combined these ideas in a new and useful way.”**

-- Michael, Michalko, *Creative Thinkering*,  
Machalko, 2011, p. xvii,

Combination and  
Re-Combination

- Hall duty and Teacher Advisory
- Service Learning and Students in danger of dropping out
- Miniature Golf and lesson sequence
- Students’ cafeteria behavior and architecture
- Unmotivated faculty and farming, astronomy, marble tabletops.
- Parental involvement and medicine

**Grades are compensation.**



## Have Some Fun – Anything Can Be A Metaphor!

### An apple

- a star (the birth place of energy on our planet) in the middle (the seed pattern makes a star if we cut it the right way)
- we must break the surface to get to the juicy good parts
- the outside doesn't reveal what lies inside
- the apple becomes soft and mushy over time
- the apple can be tart or sweet depending on its family background
- its parts are used to create multiple products

### A cell phone

- lifeline to the larger world
- an unapologetic taskmaster
- an unfortunate choice of gods
- a rude child that interrupts just when he shouldn't
- a rite of passage
- a declaration of independence
- a secret language encoder (text messaging abbreviations unknown to adults)
- delineation of generations
- 

### A pencil sharpener

- Whittler of pulp
- Tool diminisher
- Mouth of a sawdust monster
- Eater of brain translators
- Cranking something to precision
- Writing re-energizer
- Scantron test enabler

### Curtains

- Wall between fantasy and reality
- Denied secrets
- Anticipation
- Arbiter of suspense
- Making a house a home
- Vacuum cleaner antagonist
- Cat's "Jungle Gym"

### Railroad

- Circulatory system of the country
- Enforcer of Manifest Destiny
- Iron monster
- Unforgiving mistress to a hobo
- Lifeline
- Economic renewal
- Relentless beast
- Mechanical blight
- Movie set
- A foreshadow of things to come
- A hearkening to the past

## Metaphors Break Down

**“You can’t think of feudalism as a ladder because you can climb up a ladder. The feudal structure is more like sedimentary rock: what’s on the bottom will always be on the bottom unless some cataclysmic event occurs.”**

-- Amy Benjamin, *Writing in the Content Areas*, p. 80

## Questioning the Metaphor

Find a way to improve the metaphor or analogy:

“Man has been here 32,000 years. That it took a hundred million years to prepare the world for him is proof that that is what it was done for. I suppose it is. I dunno. If the Eiffel tower were now representing the world's age, the skin of paint on the pinnacle-knob at its summit would represent man's share of that age; & anybody would perceive that that skin was what the tower was built for. I reckon they would. I dunno. - "Was the World Made for Man?" (from, [www.twainquotes.com](http://www.twainquotes.com))

## Test the Verb Strength

Did we *invade* the country, or did we *liberate* it? The choice of verbs frames our thinking. Ask students to change only the verb and explain how the reader or listener's interpretation of the topic would change as a result.

The senator *corralled* her constituents.  
The senator *coddled* her constituents.  
The senator *ignited* her constituents.  
The senator *stonewalled* her constituents.  
The senator *suckered* her constituents.  
The senator *mollified* her constituents.  
The senator *lifted* her constituents.

## Same Concept, Multiple Domains

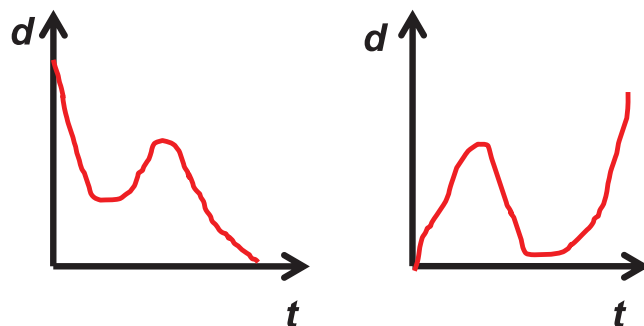
The Italian Renaissance: Symbolize curiosity, technological advancement, and cultural shifts through mindmaps, collages, graphic organizers, paintings, sculptures, comic strips, political cartoons, music videos, websites, computer screensavers, CD covers, or advertisements displayed in the city subway system.

The economic principle of supply and demand: What would it look like as a floral arrangement, in the music world, in fashion, or dance? Add some complexity: How would each of these expressions change if were focusing on a bull market or the economy during a recession?

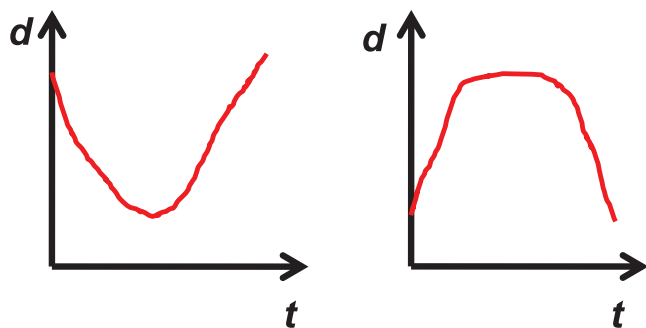
Creating and interpreting patterns of content, not just content itself, creates a marketable skill in today's students. A look at data as indicating "peaks and valleys" of growth over time, noticing a trend runs parallel to another, or that a new advertising campaign for dietary supplements merges four distinct worlds -- Greco-Roman, retro-80's, romance literature, and suburbia -- is currency for tomorrow's employees.

To see this in a math curriculum, for example, look at algebraic patterns. Frances Van Dyke's *A Visual Approach to Algebra* (Dale Seymour Publications, 1998)

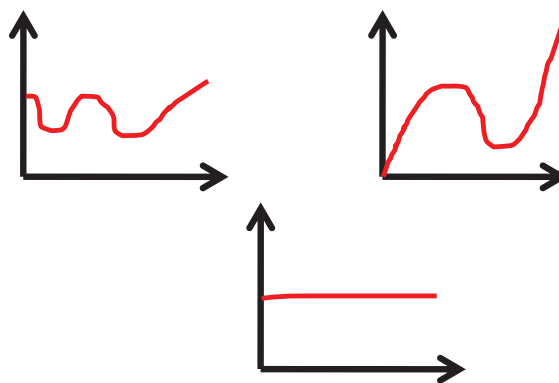
A submarine submerges, rises up to the surface, and submerges again. Its depth  $d$  is a function of time  $t$ . (p.44)



A submarine submerges, rises up to the surface, and submerges again. Its depth  $d$  is a function of time  $t$ . (*continued*)



Consider the following graphs. Describe a situation that could be appropriately represented by each graph. Give the quantity measured along the horizontal axis as well as the quantity measured along the vertical axis.



## Descriptions With and Without Metaphors

Friendship	Family
Infinity	Imperialism
Solving for a variable	Trust
Euphoria	Mercy
Worry	Trouble
Obstructionist Judiciary	Honor
Immigration	Homeostasis
Balance	Temporal Rifts
Economic Principles	Religious fervor
Poetic License	Semantics
Heuristics	Tautology
Embarrassment	Knowledge

## 4-Square Synectics

1. Brainstorm four objects from a particular category (examples: kitchen appliances, household items, the circus, forests, shopping malls).
2. In small groups, brainstorm what part of today's learning is similar in some way to the objects listed.
3. Create four analogies, one for each object.

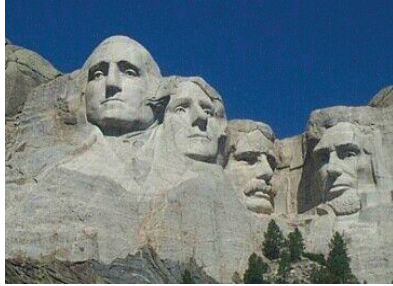
Example: *How is the human digestive system like each household item: sink, old carpet, microwave, broom*

Example: *How is the Pythagorean Theorem like each musical instrument: piano, drum set, electric guitar, trumpet?*

## Visuals and Graphics are Powerful!

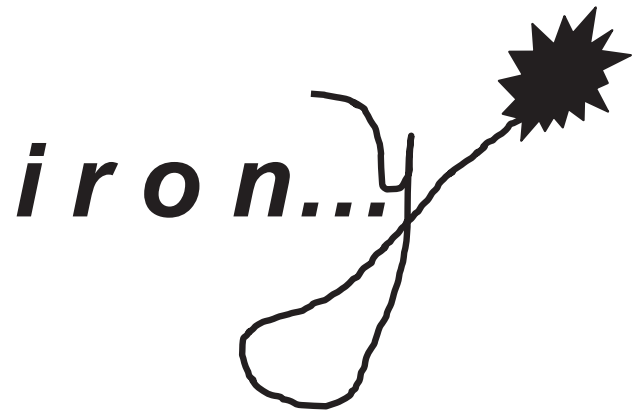
Examples:

- Shape Spelling
- Aristotle's Rhetorical Triangle (ethos, pathos, logos)



6<sup>th</sup> grade study: Some students memorized dictionary definitions, and some drew pictures to portray words and their meanings. The picture drawing group outscored the first significantly.

*Shape Spellings: Give Them a Try!*



## Statues (Body Sculpture)

Students work in small groups  
using every groupmember's body  
to symbolically portray concepts  
in frozen tableau.

Where does the learning occur?

William's Taxonomy

Fluency  
Flexibility  
Originality  
Elaboration  
————— Risk Taking —————  
Complexity  
Curiosity  
Imagination

Frank Williams' Taxonomy of Creative Thinking

**Fluency – We generate as many ideas and responses as we can**

Example Task: Choose one of the simple machines we've studied (wheel and axle, screw, wedge, lever, pulley, and inclined plane), and list everything in your home that uses it to operate, then list as many items in your home as you can that use more than one simple machine in order to operate.

**Flexibility – We categorize ideas, objects, and learning by thinking divergently about them**

Example Task: Design a classification system for the items on your list.

Frank Williams' Taxonomy of Creative Thinking

**Originality – We create clever and often unique responses to a prompt**

Example Task: Define life and non-life.

**Elaboration – We expand upon or stretch an idea or thing, building on previous thinking**

Example: What inferences about future algae growth can you make, given the three graphs of data from our experiment?

**Risk Taking – We take chances in our thinking, attempting tasks for which the outcome is unknown**

Example: Write a position statement on whether or not genetic engineering of humans should be funded by the United States government.

**Complexity – We create order from chaos, we explore the logic of a situation, we integrate additional variables or aspects of a situation, contemplate connections**

Example: Analyze how two different students changed their lab methodology to prevent data contamination.

**Curiosity – We pursue guesses, we wonder about varied elements, we question.**

Example: What would you like to ask someone who has lived aboard the International Space Station for three months about living in zero-gravity?

**Imagination – We visualize ideas and objects, we go beyond just what we have in front of us**

Example: Imagine building an undersea colony for 500 citizens, most of whom are scientists, a kilometer below the ocean's surface. What factors would you have to consider when building and maintaining the colony and the happiness of its citizens?

Character	Setting	Conflict
Former spy School teacher Egyptian Pharaoh Mid-wife in WWII Southern slave Alien being scientist Witness to a violent crime 13 year-old prodigy A chocolate lab (dog) Optimistic Lawyer Older, married couple Comic book illustrator Champion pie-maker National Park ranger	FL Everglades Civil War, GA the C.I.A. 1870 Ireland Deep w/in Earth's crust suburbia modern Hollywood transatlantic crossing Inner city Chicago Ancient Rome Undersea laboratory Mars Orbiter the Fourth Dimension Pacific northwest Peruvian Andes	Betrayal Release of deadly microbe Political infighting survival in hostile planet Military uncovers a mistake by Pres. Accused of crime didn't commit Alzheimer's disease Issue re-connecting w/grown children horrific hurricane Miniaturized to 3 in. tall Brain transferred to android Romantic misunderstanding Wrong place at the wrong time Mysterious code found neophyte battles entrenched veterans

**Writer and educator, Margaret Wheatley, is correct:**

***“We can’t be creative unless we’re willing to be confused.”***

**12 Practices to Build Creativity and Critical Thinking in your Teaching:**

1. Learn content or a new skill outside of your subject discipline.
2. Practice creative thinking.
3. Build instructional versatility; we can’t be creative with what we don’t have.
4. Brainstorm – a lot.
5. Accept life’s complexity.
6. Read.
7. Listen.

8. Regularly do automatic tasks and let your mind roam.
9. Do activities that have no extrinsic reward associated with them.
10. Design multiple access points and meaning-making experiences for students.
11. Open instruction to professional critique
12. Re-consider what you have around you.

*"All thinking begins with wonder."  
-- Socrates*



Our job is not to make up anybody's mind, but to open minds and to make the agony of decision-making so intense you can escape only by thinking.

-- Fred Friendly, broadcaster

What if the fellow who never makes a mistake takes his orders from one who does?

What if the fellow who never makes a mistake takes his orders from one who does?

-- Herbert Prochnow

If I had been a kid in my class today, would I want to come back tomorrow?

-- Elsbeth Murphy

Nothing ventured, something lost.

-- Roland Barth

### Negating Students' Incorrect Responses

What if the fellow who never makes a mistake takes his orders from one who does?

- Get interested Tell me more about that?
- Empathy and Sympathy I used to think that too, or I understand how you could conclude that?
- Alter the reality:
  - Change the question so that the answer is correct
  - What's the answer for the question I'm about to ask
  - When student claims he doesn't know as if you DID know, what would you say?

### Negating Students' Incorrect Responses and

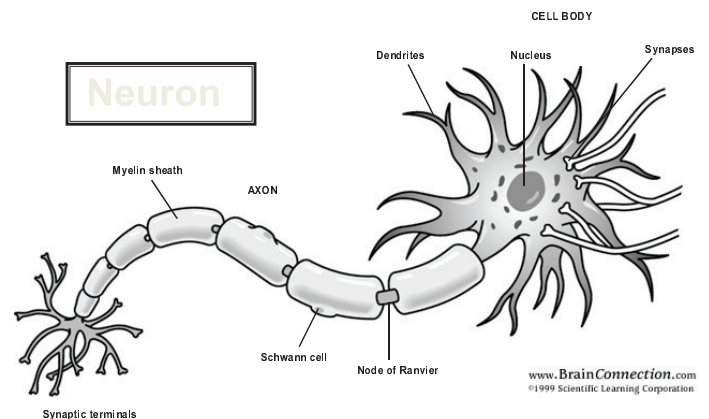
What if the fellow who never makes a mistake takes his orders from one who does?

- Firm risk-taking
- Allow the student more time or to ask for assistance
- Focus on the portions that are correct

What if the fellow who never makes a mistake takes his orders from one who does?

- What if the fellow who never makes a mistake takes his orders from one who does?
- What if the fellow who never makes a mistake takes his orders from one who does?

*Healthy diet, exercise, and sleep help production of both!*



- The teacher responds to students' classmates is doing the learning. Make sure the majority of the time it's the students responding and summarizing, not the teacher.
- Teachers ask 80 questions each hour on average while students ask only two during that same hour. Collaborative students learn more when they ask the questions. Find ways to make question-asking so compelling and habitual they can't escape it.

[illegible][illegible]

*Chance favors  
the prepared mind.*

## The Brain's Dilemma: What Input to Keep, and What Input to Discard?

**The brain never stops  
paying attention.  
It's always  
paying attention.**

- Survival
- Familiarity/Context
- **Priming**
- Intensity
- Emotional Content
- Movement
- Novelty

-- Summarized from Pat Wolfe's *Brain Matters*, 2001

Prime the brain prior to asking students to do any learning experience.

Priming means we show students:

- 1) What they will get out of the experience (the objectives)
- 2) What they will encounter as they go through the experience (itinerary, structure)

Worthy they were,  
 Rafael, Leonardo, Michelangelo, and Donatello.  
 Theirs' a chromatic and plumed rebirth,  
 'A daring reflection upon man.  
 Beyond Hastings and a Wife's tale in Canterbury,  
 Galileo thrust at more than Windmills,  
 He, Copernicus Gravitas.  
 And for the spectre of debate,  
 religion blinked then jailed,  
 errant no more,  
 thereby errant forever.  
 Cousin to Pericles, Son of Alexander,  
 The cosmology of Adam fanned for all,  
 feudal plains trampled by trumpeters,  
 man and woman lay awake --  
 calves on wobbly legs,  
 staring at new freedom  
 and Gutenberg's promise.

## Creating Background Where There is None

- Tell the story of the Code of Hammurabi before discussing the Magna Charta.
- Before studying the detailed rules of baseball, play baseball.
- Before reading about how microscopes work, play with microscopes.
- Before reading the Gettysburg Address, inform students that Lincoln was dedicating a cemetery.

## Creating Background Where There is None

- Before reading a book about a military campaign or a murder mystery with references to chess, play Chess with a student in front of the class, or teach them the basic rules, get enough boards, and ask the class to play.
- In math, we might remind students of previous patterns as they learn new ones. Before teaching students factorization, we ask them to review what they know about prime numbers.
- In English class, ask students, *"How is this story's protagonist moving in a different direction than the last story's protagonist?"*
- In science, ask students, *"We've seen how photosynthesis reduces carbon dioxide to sugars and oxidizes water into oxygen, so what do you think the reverse of this process called, 'respiration,' does?"*

- Chess masters can store over 100,000 different patterns of pieces in long term memory. Chess players get good by playing thousands of games!
- Experts think in relationships, patterns, chunks, novices keep things individual pieces.
- Physics experiment in categorization...
- Solid learning comes from when students make the connections, not when we tell them about them.

## Perception

B

Perception is when we bring meaning to the information we receive, and it depends on prior knowledge and what we expect to see. (Wolfe, 2001)

Are we teaching so that students perceive, or just to present curriculum and leave it up to the student to perceive it?

portant for all ages when oing  
 content into longter eory

Students have to do both,

Access → Sense-Making

Process → Meaning-Making

## Journalistic vs. Encyclopedic Writing

**“The breathing of Benbow’s pit is deafening, like up-close jet engines mixed with a cosmic belch. Each new breath from the volcano heaves the air so violently my ears pop in the changing pressure – then the temperature momentarily soars. Somewhere not too far below, red-hot, pumpkin size globs of ejected lava are flying through the air.”**

-- National Geographic, November 2000, p. 54

“A volcano is a vent in the Earth from which molten rock (magma) and gas erupt. The molten rock that erupts from the volcano (lava) forms a hill or mountain around the vent. Lava may flow out as viscous liquid, or it may explode from the vent as solid or liquid particles...”

-- Global Encyclopedia, Vol. 19 T-U-V, p. 627

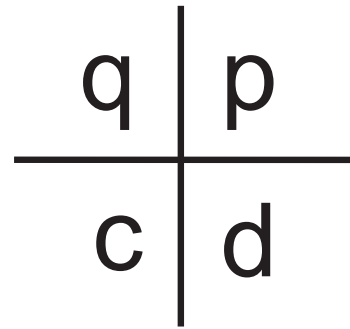
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### Traditional Learning

- Part to whole, emphasize skills
- Strict adherence to curriculum
- Rely on textbooks, worksheets
- Students are “blank slates”
- Teachers disseminate info
- Teachers seek correct answer to facilitate learning
- Assessment and teaching separate

### Constructivist Learning

- Whole to part, emphasize concepts
- Pursue student questions
- Rely on prior sources, analogies
- Students are thinkers
- Teachers facilitate, interact
- Teachers seek students’ knowledge to make decisions
- Assessment and teaching are interwoven



Which letter does not belong, and why?

## Inquiry Method

1. Something arouses students’ curiosity.
2. Students identify questions regarding topic. There is usually one main question with several sub-questions that help answer the main question. These questions are submitted to classmates for review.
3. Students determine the process of investigation into topic. Their proposal for how to conduct the investigation is submitted to classmates for review and revision as necessary.
4. Students conduct the investigation.
5. Students share their findings.

## Socratic Seminar

### Pre-Seminar:

- A. Shared experiences, chosen for richness of ideas, issues, ambiguity, “discussability”
- B. Students reflect on material  
Group dynamics, ground rules, and courtesy are understood and accepted.

### Seminar:

- A. Teacher asks a provocative question. Opening, Core, and Closure Questions
  - B. Students respond to the provocative question and each other.
  - C. Teacher offers core questions that help students interpret and to re-direct, also evaluates and tries to keep mouth shut.
- C. Closing – connect to the real world of the student

### Post-Seminar

Writings, Summations, Artwork, Reflection, Critique, Analysis



## Debate Format

1. Statement of the General Debate Topic and Why it's Important – 1 min.
2. Affirmative Position Opening Remarks – 3 min.
3. Negative Position Opening Remarks – 3 min.
4. Affirmative Position Arguments – 5 min.
5. Negative Position Arguments – 5 min.
6. Caucus – Students on both teams consider their arguments and rebuttals in light of what has been presented. – 3 min.
7. Affirmative Rebuttal and Questioning of the Negative's Case – 3 min.
8. Negative Rebuttal and Questioning of the Affirmative's Case – 3 min.
9. Closing Arguments Affirmative Position – 2 min.
10. Closing Arguments Negative Position – 2 min.



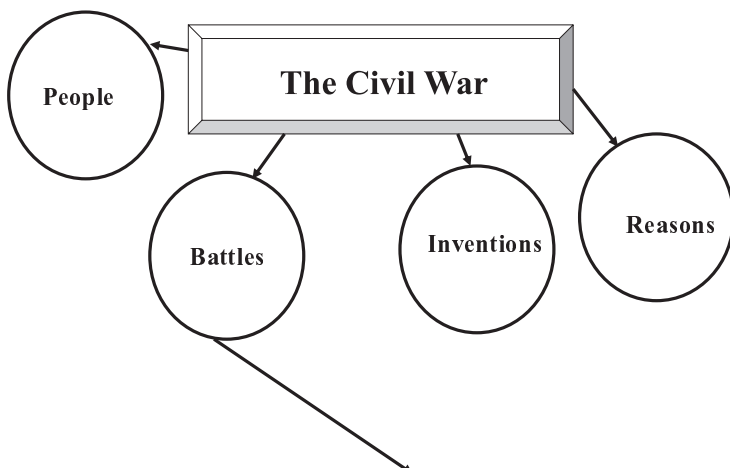
## Components of Blood Content Matrix

	Red Blood Cells	White Blood Cells	Platelets	
Purpose				
Count				
Life Span				
Nucleus				
Where Formed				

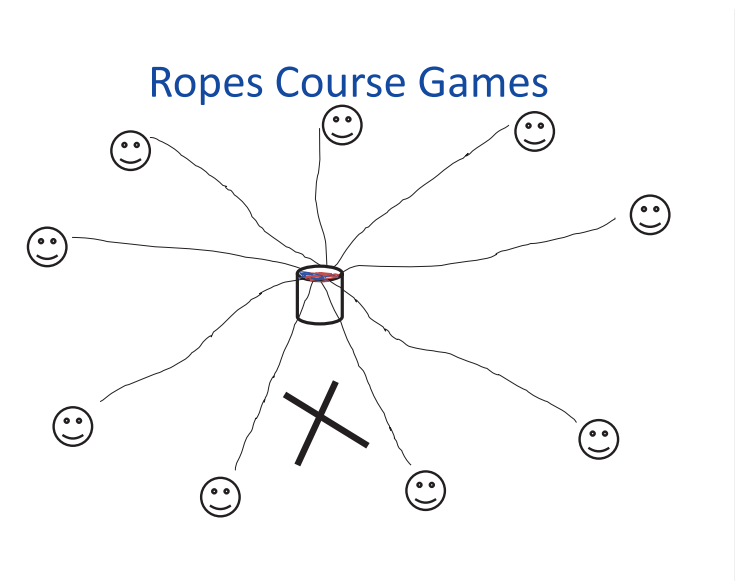
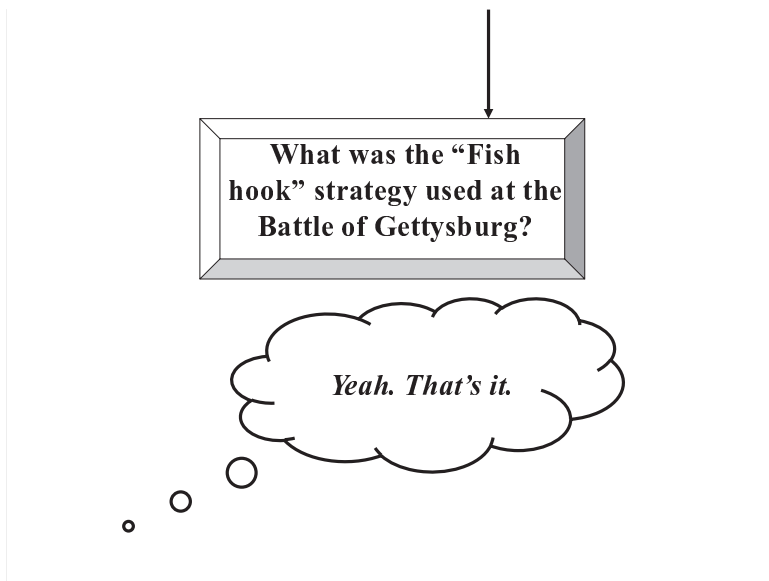
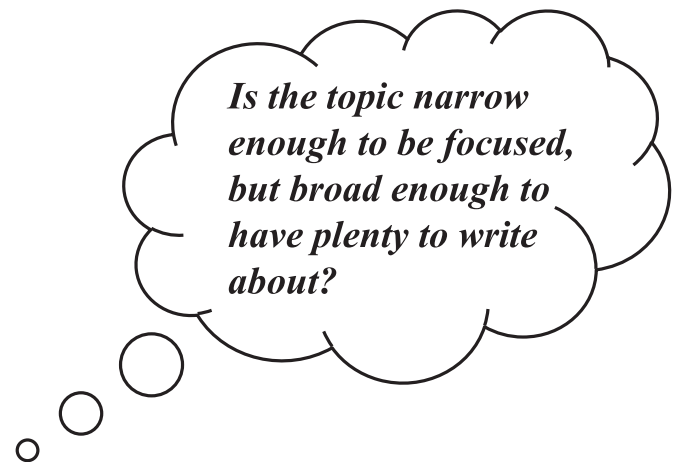
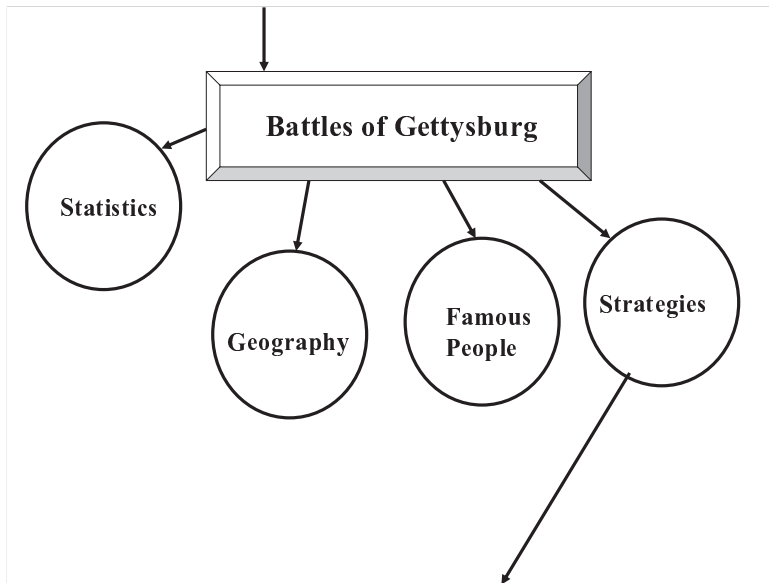
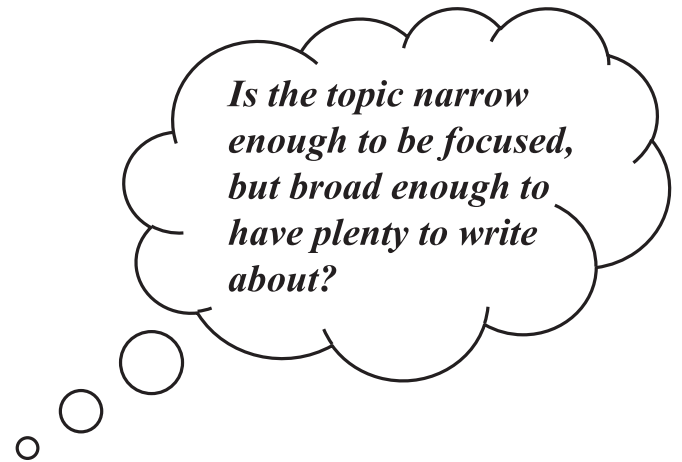
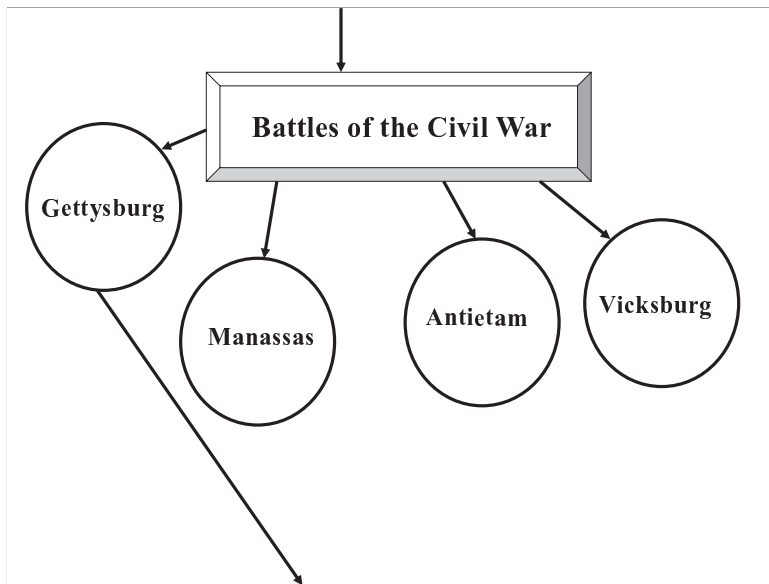
## The student's rough draft:

Red blood cells carry oxygen and nutrients around the body. They are small and indented in the middle, like little Cheerios. There are 5 million per cc of blood. There is no nucleus in mature red blood cells. They are formed in the bone marrow and spleen.

## Narrowing the Topic



*Is the topic narrow enough to be focused, but broad enough to have plenty to write about?*



## Ropes Course Games

**Electric Fence** (Getting over triangle fence without touching)

**Spider Web** (Pass bodies through “webbing” without ringing the attached bells)

**Group Balance** (2'x2' platform on which everyone stands and sings a short song)

**Nitro-glycerin Relocation** (previous slide)

**Trust Falls** (circle style or from a chair)

## Line-up

- Groups of students line up according to criteria. Each student holds an index card identifying what he or she is portraying.
- Students discuss everyone's position with one another -- posing questions, disagreeing, and explaining rationales.

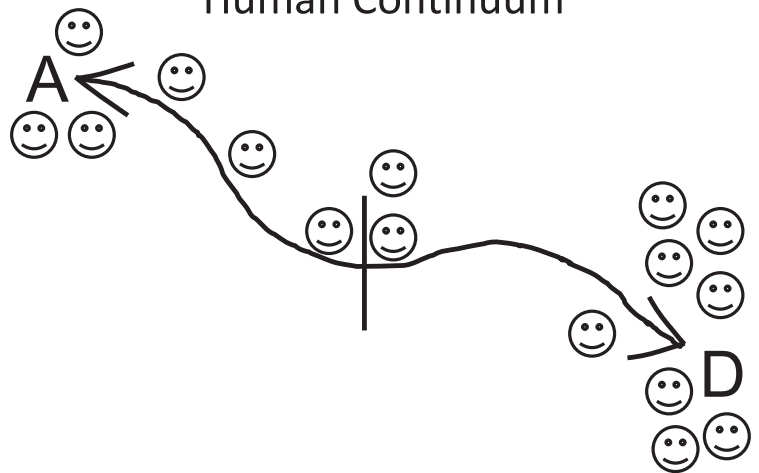


## Line-up

Students can line-up according to:

*chronology, sequences in math problems, components of an essay, equations, sentences, verb tense, scientific process/cycle, patterns: alternating, category/example, increasing/decreasing degree, chromatic scale, sequence of events, cause/effect, components of a larger topic, opposites, synonyms*

## Human Continuum



## Human Continuum

Use a human continuum. Place a long strip of masking tape across the middle of the floor, with an "Agree" or "Yes" taped at one end, and "Disagree" or "No" at the other end. Put a notch in the middle for those unwilling to commit to either side. Read statements about the day's concepts aloud while students literally stand where they believe along the continuum. Be pushy – ask students to defend their positions.

To Increase (or Decrease) a Task's Complexity,

add or remove these attributes

- Manipulate information, not just echo it
- Extend the concept to other areas
- Integrate more than one subject or skill
- Increase the number of variables that must be considered; incorporate more facets
- Demonstrate higher level thinking, i.e. Bloom's Taxonomy, William's Taxonomy
- Use or apply content/skills in situations not yet experienced
- Make choices among several substantive ones
- Work with advanced resources
- Add an unexpected element to the process or product
- Work independently
- Reframe a topic under a new theme
- Share the backstory to a concept – how it was developed
- Identify misconceptions within something

To Increase (or Decrease) a Task's Complexity,

add or remove these attributes

- Identify the bias or prejudice in something
- Negotiate the evaluative criteria
- Deal with ambiguity and multiple meanings or steps
- Use more authentic applications to the real world
- Analyze the action or object
- Argue against something taken for granted or commonly accepted
- Synthesize (bring together) two or more unrelated concepts or objects to create something new
- Critique something against a set of standards
- Work with the ethical side of the subject
- Work in with more abstract concepts and models
- Respond to more open-ended situations
- Increase their automaticity with the topic
- Identify big picture patterns or connections
- Defend their work

change the verb

Instead of asking students to describe how FDR handled the economy during the Depression, ask them to rank four given economic principles in order of importance as they imagine FDR would rank them, then ask them how President Hoover who preceded FDR would have ranked those same principles differently.

Analyze...	Construct...
Revise...	Rank...
Decide between...	Argue against...
Why did...	Argue for...
Defend...	Contrast...
Devise...	Develop...
Identify...	Plan...
Classify...	Critique...
Define...	Rank...
Compose...	Organize...
Interpret...	Interview...
Expand...	Predict...
Develop...	Categorize...
Suppose...	Invent...
Imagine...	Recommend...

Practice Complex-ifying.

‘Really.

‘A lot.

Practice turning regular education objectives and tasks into advanced objectives and tasks.

## Great Vocabulary Homework Assignments

change spellings

restaurant menu

Want sea or like oysters

awesome arts

vocabulary usually arts

open petition conversation using

vocabulary

## Great Writing Homework Assignments

descriptive paragraph with no adjectives

“Show, Don’t Tell” samples

new Words youaries

Proving historical fiction’s authenticity

role, audience, format, topic (title), strong  
character or hero

inventing a new language (beyond just an alphabet code)

# Great Math Homework Assignments

---

- analyze how four different students complete the same math problem
- Write about a math discovery that changes the world
- draft a proposal to the city council for a bridge structure for a river, explaining why it is the sturdiest and most cost-efficient option
- present a report on the geography of a gas field all court
- design a lunar colony that is only one-third of the dimensions of Earth, schematic designs included
- understand any interest earned on a savings account in which the interest rate changes twice
- in auto photography of a right angle
- create a physical demonstration or expression of an abstract math concept

**Write about a path discovery that changed the world**

Submit a proposal to the city council for a bridge structure or a river, explaining why it is the sturdiest and most cost-efficient option.

☐ Present a report on the geography of a designated all court

Design a lunar colony ☐ a) only of three-dimensional solids, schematic designs include ☐

☐ u ☐ any o ☐ interest earne ☐ on a sa ☐ ings account in which the interest rate change ☐ twice ☐

□n auto□iography o□a right angle□

□ create a physical □e□ onstration or expression o□an a□stract □ath  
concept□

# Great Social studies/history Homework Assignments

---

- conversation □etween two □amous people
- how a piece of literature changed an era
- n analysis o□a political cartoon (or create one)
- comic strip that retells a □amous inci□ent

A response to the question, “If someone from the time period we’re studying were around □to□ay, what would □he say a□out □o□ern world □issues?”

- ple□ge anthe □llag constitution □or a historical □o□e □ent
- □o□ie poster with eye □atching graphics, titles, sound □□ite reviews □ro □o□ie critics, an □a list o□the cast an □crew responsible □or the □il □a□out □□□□□□□□□□□□□□□□ (□ill in the vocabulary term, such as “democracy”)

□ con□ersation □etween two □a□ous people

**'how a piece of literature changed an era**

☐ an analysis of a political cartoon (or create one)

□ comic strip that retells a □ous incident

**A response to the question, “If someone from the time period we’re studying were around today, what would he say about our world issues?”**

☐ pledge the flag constitution or a historical document

☐ ☐ The poster with eye-catching graphics, titles, soundbite reviews or quotes from critics, and a list of the cast and crew responsible for the film about \_\_\_\_\_ (fill in the vocabulary term, such as “democracy”)

# Great Science Homework Assignments

---

Write the life story of a                                 

Create a science calendar in which the picture for each month contains                                 

Describe                          for a period of          days and enter in two hypotheses about it that would          a          for good investigations

Examine a common notion on science misconception and how it is perpetuated

Explain why another student obtained certain lab results

Create a board game focusing on the basic steps of          (insert science cycle or principle)

Collect and categorize your collection of                                 

**Write the life story of a**

create a science calendar in which the picture for each month conveys

**series** or a period of days and later in two hypotheses about it that would be good investigations

## Examine a common science misconception and how it is perpetuated

**Explain why another student obtained certain lab results**

Create a 1000 word essay focusing on the basic steps of (insert science cycle or principle)

Collect an  categorize your collection of

# Great Art

## Homework Assignments

---

Write autobiographies to go with portraits

sculpt with clay while using writing process terms

Answer the question: "If a picture/sculpture could talk, what would it say?"

Develop synthesis writings: "What does blue sound like?"  
"Describe red through other senses and experiences not associated with what we can see."

explain what a piece of art tells us about a particular time period

explain how four different art concepts are expressed in a group

## Write autobiographies to go with portraits

- sculpt with clay while using writing process terms

**Answer the question: “If a picture/sculpture could talk, what would it say?”**

**Develop synthesis writings: “What does blue sound like?”  
“Describe red through other senses and experiences not  
associated with what we can see.”**

Explain what a piece of art tells us about a particular time period

Explain how four different art concepts are expressed in a contemporary painting.

# Great Physical Education Homework Assignments

---

- design an maintain a personal daily exercise regimen for two weeks
- design a Website or library display that promotes at least four successful ways to get into good physical shape
- explain the impact of exercise on metabolic, muscle health, and academic learning in a way that's appropriate for students four years younger than you
- identify one life important decision you have to make and hold it up to each of the criteria for successful decision making
- determine the target heart rate for people with the following characteristics

**Design an 8-week maintain a personal daily exercise regimen or two weeks**

Design a Web site or library display that promotes at least four successful ways to get into good physical shape.

Explain the impact of exercise on metabolism, muscle health, and academic learning in a way that's appropriate for students four years younger than you.

Identify one life-important decision you have to make and hold it up to each of the criteria for successful decision-making.

☐eter ☐ine the target heart rate ☐or people with the ☐ollowing characteristics ☐

# Great Thinking Homework Assignments

---

Translate the passage from French to English.

What's the difference between osmosis and diffusion?

Classify the items according to their origin.

Explain how any whole number with an exponent of zero equals one.

Which part/word doesn't fit?

Which comments support the President's position?

Predict what would happen if we change the temperature in the terrarium.

Determine the surface area of the building.

Explain how music changes the tone of the film.

☐ Translate the passage from French to English.

### What's the difference between osmosis and diffusion?

Classify the items according to their origin

Explain how any whole number with an exponent of zero equals one.

**Which part/word doesn't fit?**

**Which comments support the President's position?**

**predict what would happen if we change the temperature in the terrarium**

meter in the surface area of the building

Explain how music change the tone of the film

# Great Thinking Homework Assignments

---

Which country do you think sees politics most objectively?

Defend the character's decision to \_\_\_\_\_.

What's the logical fallacy in his argument?

What is the most important scene in the novel? How would it change?

Design a better inventory system.

Which persuasive essay is most convincing and why?

According to the standards set forth by the treaty, is the country in compliance? Explain.

Which algorithm is the most efficient and why?

Prove upon the idea in at least one way.

Processing Activity:

“I used to  
think...  
but now  
I think...”